PANASAS

CUSTOMER SUCCESS

Summary

Customer The Cryo-EM Facility at University of Wollongong's Molecular Horizons Research Institute

Location Wollongong, New South Wales, Australia

Scope $80 million collaborative research facility equipped with world-leading technologies, including $20 million microscopy equipment.

Industry Life Sciences

Challenge Data-intensive cryo-EM research at Molecular Horizons had outpaced its original commodity storage infrastructure.

Solution Panasas storage boosted performance, increased capacity, and provided the lab with the scalability necessary to carry out instrument upgrades – all while lowering management overhead.

Results The Panasas storage platform accelerated the facility's workflows and marked the beginning of a collaborative partnership between the two organizations that will fuel cutting-edge research initiatives.

MOLECULAR HORIZONS | UOW AUSTRALIA

University of Wollongong's Molecular Horizons Institute Leads the Way With Cryo-EM

AT MOLECULAR HORIZONS, SEEING GOES BEYOND BELIEVING

Scientists at Molecular Horizons Institute are using cryogenic electron microscopy (cryo-EM) to reveal the wonders of the cellular universe and solve the 21st century's most pressing health challenges – one molecule at a time.

Located at the University of Wollongong, the new world-class research institute serves multidisciplinary teams making discoveries in structural biology with state-of-the-art imaging technologies. The institute's crown jewel is a Thermo Fisher FEI Titan Krios, one of the most powerful devices in cryo-EM today. In addition, the cryo-EM facility also houses a Thermo Fisher FEI Talos Arctica and Tecnai T-12 platforms.

Cryo-EM lets scientists visualize critical biomolecules that have long eluded other imaging techniques, such as x-ray crystallography. And thanks to new breakthroughs in microscopes, direct electron detectors, and data collection software, cryo-EM can now capture images of those molecules with atomic precision. This "resolution revolution" has led to a surge in research activity: In 2021, cryo-EM determined over 3,000 new protein structures, up from about 550 just five years prior.

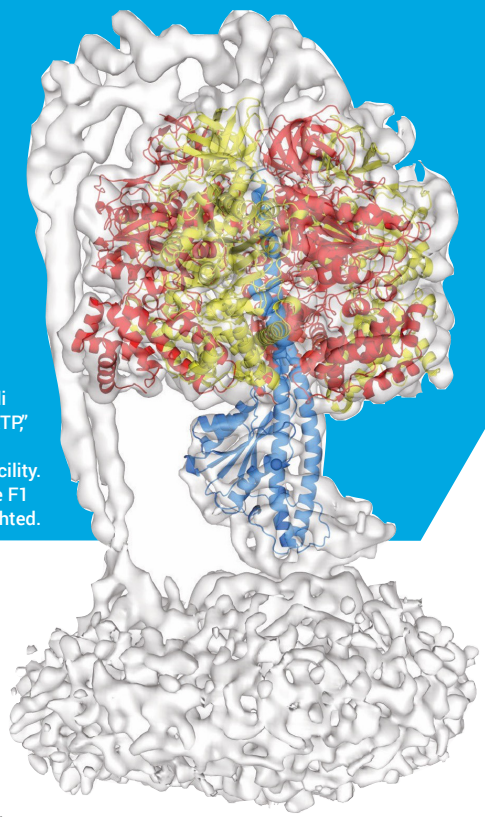
Specimen preparation begins with a flash freezing process that traps the molecules in a thin layer of vitreous

PANASAS

CUSTOMER SUCCESS

"This area of research is very data-intensive, and partnering with Panasas represents a big step for us in realizing our vision in this sector."

Dr. Antoine van Oijen
Executive Director at Molecular Horizons, University of Wollongong



Sobti et al., "Cryo-EM reveals distinct conformations of E. coli ATP synthase on exposure to ATP," eLife (2019). Acquired at UOW Molecular Horizons cryo-EM facility. ATPsynthase molecule with the F1 motor domain structure highlighted.

ice. Beams of electrons are then fired at the frozen sample, and the detector beneath captures 2D images of the molecules frozen in various orientations. Advanced software analyzes and processes those images before combining all of the different orientations into a single rendering. The result is a high-resolution 3D model displaying the molecule's complete structure.

Seeing these shapes is vital to understanding how molecules behave, which in turn unlocks the door to new interventions in medicine. The scientists uncovering these new structures at Molecular Horizons are using them to push critical health initiatives forward, from combatting antimicrobial resistance to creating new methods of cancer detection, prevention, and treatment.

Dr. Antoine van Oijen, distinguished professor at the University of Wollongong and Executive Director at Molecular Horizons, reminds us that "developing new cures and therapeutics relies on a foundation of fundamental research, particularly on the structure and function of biological molecules." That fundamental research relies on a foundation of its own: a data storage platform capable of supporting it.

The Data Storage Challenge in Cryo-EM

In the beginning, Molecular Horizons attempted to simplify their IT infrastructure by taking a commodity approach, so commercial off-the-shelf systems comprised the cryo-EM facility's original 100 terabytes of storage. But once they began ramping up research and tuning instruments to drive new discoveries, the teams ran into issues relating to that storage – such as time-consuming administrative burdens, lowered performance, limited scalability, and a lack of technical support — that hindered their research efforts.

Consider that an individual raw dataset in cryo-EM ranges from 5 to 40 terabytes. The institute's imaging devices, which run for roughly 80% of the year, operate almost 24/7 with real-time processing. This means that a single cryo-EM microscope can easily generate multiple petabytes of data per year. And those microscopes can be further enhanced by upgrading the direct detectors, increasing their data output several fold.

The bottom line: Cryo-EM pipelines require a scalable, reliable, and high performance data storage platform capable of processing vastly growing quantities of data.

When Molecular Horizons realized that their commodity storage could not measure up to that task, they seized the opportunity to rebuild. But while their ambitions were limitless, funding, of course, was not (the Titan Krios alone is a costly machine, carrying a price tag in the range of millions). Ultimately, the facility needed a storage foundation that could support their present and future cryo-EM goals – one that came with controlled costs, a collaborative partnership, and zero performance compromises.

Panasas delivered on all fronts.

PANASAS

CUSTOMER SUCCESS

"This will allow us to accelerate workloads...We're going to get really fast access to files, to the active layer."

Dr. James Bouwer
Director of Cryo-EM at Molecular Horizons

Dr. Bouwer with the facility's Thermo Fisher Titan Krios cyro-electron microscope.

Panasas Delivers a Future-Ready Data Storage Foundation

In 2021, Molecular Horizons deployed Panasas ActiveStor® scale-out storage. Beyond the remarkably reasonable cost per terabyte, the institute's decision was based on Panasas' longstanding expertise in life sciences as well as the storage platform's exceptional suitability and manageability. Since the deployment, researchers have found that they can now rapidly store, retrieve, and analyze unprecedented volumes of data.

The PanFS® parallel file system is engineered to expertly handle large dataset workflows like those at the cryo-EM facility. With its Dynamic Data Acceleration technology, PanFS self-manages files by size, placing them on the appropriate storage media without the need for administrative intervention. This tierless, "always hot" storage maximizes system performance while simultaneously eliminating the complexity of tiered storage systems.

Dr. James Bouwer, Director of Cryo-EM, spoke directly about how the facility has benefited from choosing Panasas: "This will allow us to accelerate workloads and store important data for our various research projects. We're going to get really fast access to files, to the active layer. This collaboration between two very high-value players coming together in true partnership will support Australian science in general, and more specifically, the University's role in furthering our understanding in these important areas of science."

The Panasas data platform automatically adjusts to any type of workload that researchers can throw at it with no data bottlenecks. And since the system is linearly scalable, it readily invites upgrades in the lab that increase data output. Molecular Horizons is currently carrying out one such upgrade: they are swapping the K2 detectors on their Krios and Arctica microscopes for K3 detectors, a move which will effectively double the throughput of their data collection and significantly speed up their time to discoveries. With their previous storage, they had lacked both the capacity and the speed necessary to handle twice as much data; with Panasas, the upgrade poses no challenge.

Beyond delivering the storage, Panasas is putting their prior cryo-EM experience to use and continues to work with Molecular Horizons to optimize their workflows. Adam Marko, Director of Life Science Solutions at Panasas, described the deal as "a true collaborative effort, not just a technology sale. UOW chose Panasas because it needed a collaborative partner and a leading-edge technology supplier. Panasas will not only be providing infrastructure, but also additional engineering expertise to optimize workflows and design reference architectures."

Van Oijen summed up the institute's partnership with Panasas as an important step for the university in establishing accessible, reliable cryo-EM for the medical sciences: "This area of research is very data-intensive, and partnering with Panasas represents a big step for us in realizing our vision in this sector." With Panasas in place, Molecular Horizons can carry out their transformational research without ever having to worry about the storage foundation supporting it.